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White-headed Woodpecker monitoring for the Weiser – Little Salmon CFLRP, Payette National Forest, 2012 progress report

Submitted February 2013 by: USFS Rocky Mountain Research Station
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To: Payette National Forest
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Introduction

The Collaborative Forest Landscape Restoration Program (CFLRP) is a cooperative effort to restore ecological function to U.S. forests. Monitoring is a key component of the CFLR program and our work is designed to address how well CFLRPs are meeting their forest restoration and wildlife habitat conservation goals. The white-headed woodpecker (*Picoides albolarvatus*; WHWO) is a regional endemic species of the Inland Northwest and may be particularly vulnerable to environmental change because it occupies a limited distribution and has narrow habitat requirements in dry conifer forests. Monitoring in CFLRPs, such as the Weiser-Little Salmon Headwaters project on the Payette National Forest (PNF), also contributes to other ongoing, regional efforts to monitor effectiveness of silvicultural and prescribed-fire treatments for white-headed woodpeckers throughout their range in Idaho, Oregon and Washington. Vegetation and fuels data collection also support modeling of fire-climate impacts on future forest conditions and wildlife habitat suitability.

To meet their various ecological needs, white-headed woodpeckers require heterogeneous landscapes characterized by a mosaic of open- and closed-canopied ponderosa pine forests (Wightman et al. 2010, Hollenbeck et al. 2011), which are expected to benefit vascular plant and vertebrate wildlife populations (e.g., Noss et al. 2006). Consequently, monitoring white-headed woodpecker populations and their habitat associations is central to biological monitoring for the Weiser-Little Salmon Headwaters project on the Payette National Forest, a dry mixed-conifer forest within the range of this species. Prescribed burning and thinning treatments planned under this CFLRP are intended to improve the landscape heterogeneity required by WHWOs. Thus, the principal goal of monitoring is to verify the effectiveness of these treatments for improving habitat and populations of WHWO. This report describes the monitoring protocol, the data obtained during the first year, and future plans for monitoring.

Methods

The current monitoring plan relies on measuring WHWO occupancy rates, occupancy dynamics, and nest survival in both treated and untreated forests. Four timber sale units (areas expected to be treated; Cottonwood, Rocky Bear, Weiser River Fuels, and Lick Creek) and two control units (areas not expected to be treated; Bear and Middle Fork Weiser River) were selected for monitoring. One hundred-fifty survey points spaced at least 300 m apart and arranged in 15 transects (i.e. clusters of points) were identified in the four timber sale units and another 50 points (5 transects) in the two control units (units not expected to be treated). We selected survey points from a grid of points spaced 300 m apart that extends across the CFLRP study area. Points sampling treatment units were selected within a 1-km buffer of those units, and points sampling control units were selected from landscapes of similar forest composition and

structure as treatment units. By selecting points from this grid, models generated using data from surveyed points can be used to make predictions about WHWO distributions to non-surveyed points throughout the study area. Survey points sampling timber sale units were selected so that half of the points in each transect were located within unit boundaries and remaining points were outside unit boundaries but within 1 km of the units (i.e. areas adjacent to expected treatments). Transects are a series of adjacent points selected from the grid and do not necessarily form a straight line because the point arrangement is dependent on the size and shape of the treatment units (Figure 1). Control units are located 2 – 40 km from current timber-sale units and are not expected to be treated under the CFLR Weiser-Little Salmon Program in the near future.

We assumed that management history was analogous between treatment and control units based on similarities in forest structure and composition. Observations recorded in 2012 suggest portions of at least one control unit (Transect B T; Figure 1) received treatment within the last 7 years. All survey points were located within PNF-designated mature or over-mature forest (strata 22–24) characterized as warm, dry Douglas-fir, moist ponderosa pine, or dry grand fir (PNF Potential Vegetation Group [PVG] GIS data; PVG 2 or 5).

We visited each survey point three times during the 2012 nesting season (1st visits: 8 May – 5 June; 2nd visits: 6–18 June; 3rd visits: 19 June – 4 July; Figure 2). During each visit, the surveyor broadcast a series of WHWO vocalizations and silent periods for 4.5 minutes (2.5 min broadcast and 2 min listening) at each point to elicit responses by territorial breeding pairs (Appendix 1). Surveyors recorded the distance to WHWO detections during this period and noted the distance as < 50 m, 50–150 m, or > 150 m. Surveyors also recorded whether WHWO were detected aurally or visually. Concurrent with call-broadcast surveys at points, we searched for nests within 1 km of surveyed points (Appendix 2, Dudley and Saab 2003). We conducted nest searching daily from May – July. During this period, we searched in the vicinity of all survey points but focused especially in areas where WHWO had been observed. Once located, we monitored nests every 2-4 days on average until the nest fate (success or failure) was determined. Finally, following the conclusion of nest and call-broadcast surveys, we measured habitat features at survey points and nest locations following the protocol established for the Region 6 WHWO monitoring program (Appendix 3, Mellen-McLean et al. 2012). In addition to nest vegetation measurements, we sampled vegetation associated with 50 survey points in proposed treatment units. We focused measurements in 2012 on treatment units to ensure pre-treatment vegetation data collection. Vegetation in control and post-treatment units will be measured in future years.

Results

Of the 20 transects surveyed in 2012, we detected WHWO during 6 surveys at 5 points along 4 transects. Two transects (B T and B U, Figure 1) with detections were located in control units and two (CW A and LC R, Figure 1) in treatment units. WHWO were typically detected during only one of three visits at a given point (4 points), although they were detected twice at one point. Detections were made aurally 4 times and twice visually. During 3 detections, individuals were identified as males; gender was not identified for the remaining 3 detections.

Outside of formal surveys, WHWO were detected on four occasions before or after surveys (transects CW D, B U, and LC R, Figure 1). Non-target woodpeckers (Williamson's sapsucker [*Sphyrapicus thyroideus*], red-naped sapsucker [*Sphyrapicus nuchalis*], Hairy woodpecker [*Picoides villosus*], black-backed woodpecker [*P. arcticus*], northern flicker

[*Colaptes auratus*], and pileated woodpecker [*Dryocopus pileatus*]) were commonly detected during call-broadcast surveys.

We located and monitored the survival of 14 nests (Figure 1). Six nests were associated with 5 transects established in 3 treatment and 3 control units. The remaining nests were located in association with PNF MIS monitoring transects (Calf Pen, Summit Gulch, Shingle Flat, West Mill, Cuprum, and Crooked River; each transect with one nest, except Crooked River with two), or discovered opportunistically (Bear Work Center, one nest). Eleven of 14 nests survived to fledge at least 2 young ($\bar{x}$ = 2.55 young/successful nest).

Nests (n = 13) were associated with fewer trees than the 50 survey points measured in 2012 (Table 1). All nests were located in ponderosa pine trees in areas with lower tree and snag densities compared to survey points (Table 1). Survey point plots contained higher percentages of Douglas-fir and grand fir than nest plots.

Discussion

Call-broadcast survey data collected in 2012 were sparse, raising concerns about our ability to make strong inferences regarding treatment effectiveness. Call-broadcast data were not adequate for quantitative analysis of relevant population parameters (i.e. occupancy rates corrected for detection). WHWO were detected at relatively few sites, and where detected, they were usually detected once, suggesting both low occupancy rates and low detectability. Sparse data in general, and low detectability and occupancy rates in particular, lead to imprecise and biased parameter estimation, interfering with our ability to detect changes in parameters over time. Sparse call-broadcast data during the initial year of effectiveness monitoring is not surprising because transects were located in habitat targeted for restoration, which is currently of low suitability and where managers intend treatments to improve suitability. If suitability is improved and WHWO respond strongly and positively to silvicultural treatments, abundant call-broadcast data in subsequent years may make up for sparse call-broadcast data during initial years. Given a weak or non-existent response, however, we would be uncertain whether treatments were indeed ineffective, or if broader-scale population processes were at play. Specifically, WHWO may be absent in neighboring areas, leaving little potential for a response within a few years to treatments regardless of how much habitat suitability is improved. Nest placement based on our 2012 data, however, was consistent with that reported in Oregon (Wightman et al. 2010, Hollenbeck et al. 2011), whereby WHWOs placed their nests in habitat with relatively low canopy cover of ponderosa pine.

Future Direction

To maximize our ability to make relevant inferences about WHWO responses to restoration treatments, we propose adjusting the current monitoring protocol. We plan to replace 4 CFLRP transects (Rocky Bear transects H, I, J; and Cottonwood transect F, Figure 1) with 5 PNF MIS transects (Shingle Flat, Bear, Cuprum, Crooked River, and Deer/Lick Creek; Figure 1). No WHWO were detected in 2012 at the CFLRP transects proposed for replacement or at neighboring MIS transects. The MIS replacement transects have been consistently occupied by WHWO in recent years and transects are located within 10 km of the CFLRP transects. By implementing this adjustment to our monitoring, we will be poised to observe movements by individuals, or lack thereof, to treated units. In addition to replacement of certain transects, we will extend survey time by two minutes (from 4.5 minutes to 6.5 minutes), and examine the efficacy of increased time on WHWO detectability.

To further improve our ability to track individual movements, we plan to color-band adult and nestling WHWOs. We will concentrate efforts to locate nests within CFLRP treatment units and along neighboring MIS transects with a history of nesting WHWOs. During follow-up visits to treatment units and neighboring MIS transects, we will search for banded individuals. By documenting observations of banded birds, we will be able to determine if WHWOs use treated units. Such habitat use would suggest that forest restoration treatments were successful. These adjustments to the monitoring protocol should maximize our ability to make relevant inferences from monitoring call-broadcast data even if those data remain sparse throughout the monitoring period.

Figure 1. Weiser-Little Salmon CFLRP study area, nest locations, and transects for monitoring populations and habitat of white-headed woodpeckers on the Payette National Forest, ID.

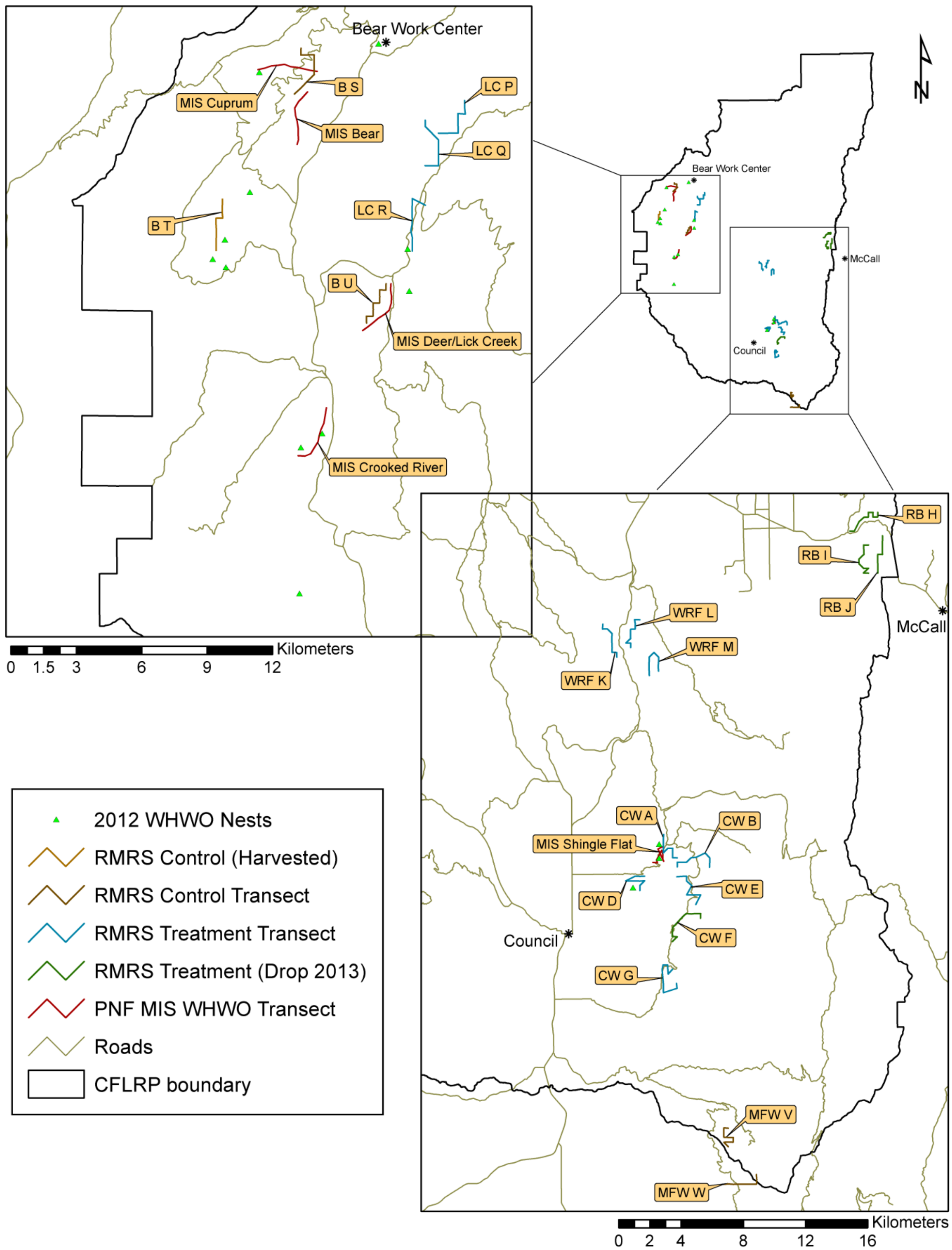

Figure 2. Typical CFLRP field map showing topographic features, CFLRP grid, roads, and transects (i.e. point clusters) established for nest searching and call-broadcast surveys of white-headed woodpeckers on the Payette National Forest, ID.

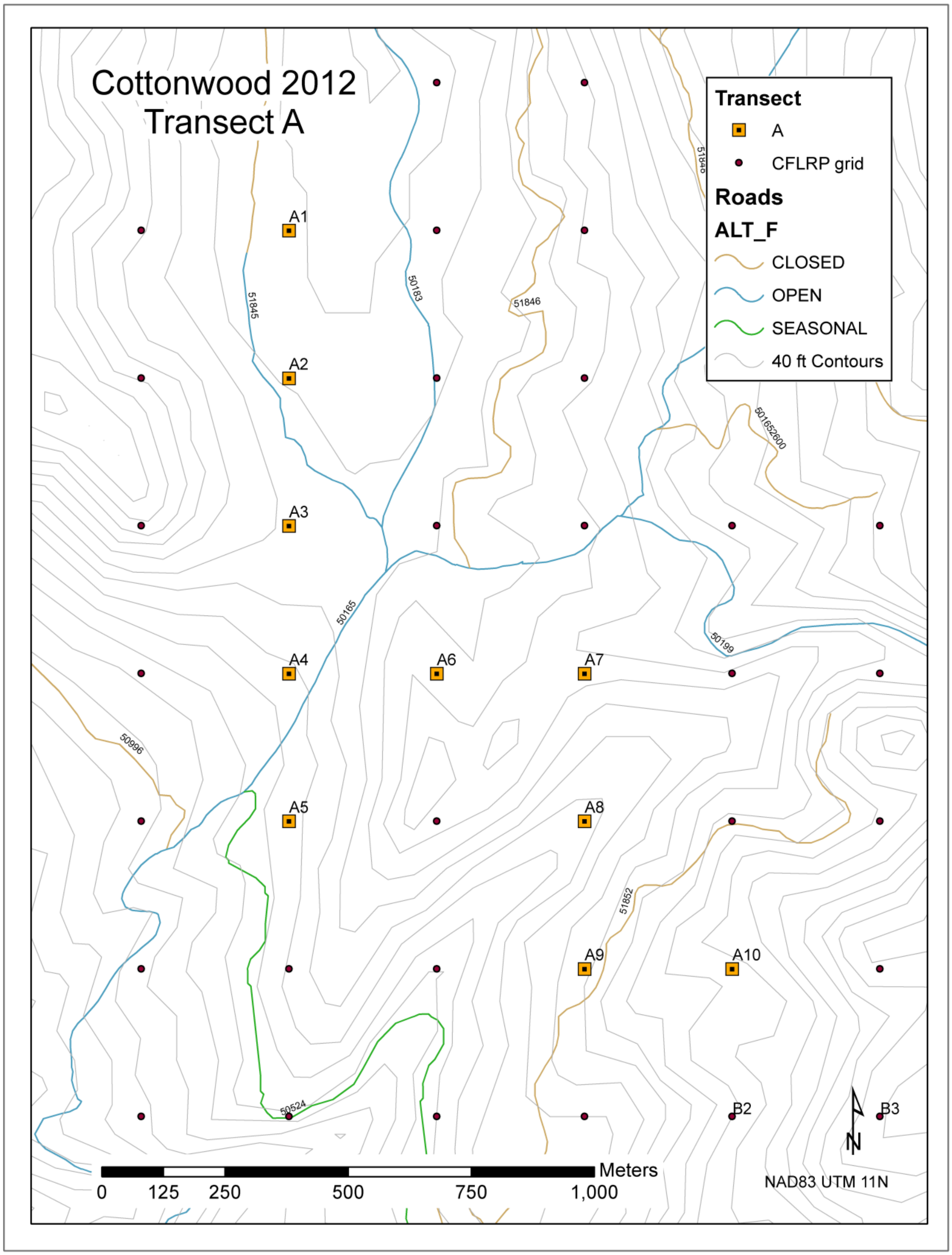

Table 1. Summary statistics (mean, SE) for vegetation measurements at call-broadcast survey stations and nest locations of white-headed woodpeckers in the Weiser-Little Salmon CFLRP, Payette National Forest, Idaho, 2012. Single-tree statistics (diameter breast height [dbh] and tree spp.) for survey station locations are from one tree selected at random within vegetation plots

	Nest (n=13)			Survey Station (n=50)		
Live trees (#/ac)						
3.94–9.83 in	15.6, 5.4			65.2, 7.3		
9.84–19.68 in	8.0, 1.7			46.7, 3.1		
≥ 19.69 in	4.3, 1.0			18.2, 1.4		
Snags (#/ac)						
3.94–9.83 in	2.7, 1.3			6.2, 0.9		
9.84–19.68 in	2.5, 1.1			3.8, 0.5		
≥ 19.69 in	0.7, 0.3			1.4, 0.3		
Dbh (in)	19.0, 3.1 (n=12)			17.3, 1.1		
	3.94–9.83 in	9.84–19.68 in	≥ 19.69 in	3.94–9.83 in	9.84–19.68 in	≥ 19.69 in
Tree spp. (%)[a]						
ABGR	0	0	0	0	8	8
PIPO	17	50	33	2	24	20
PSME	0	0	0	8	18	12
Plot tree spp. (%)[a]						
ABGR	0, 0.0	0, 0.0	0, 0.0	5, 1.1	6, 1.0	5, 1.4
LAOC	0, 0.0	0, 0.0	0, 0.0	0.1, 0.1	0.3, 0.1	0.1, 0.1
PIPO	16, 3.4	34, 6.6	42, 8.2	10, 1.7	16, 2.2	21, 2.4
Populus spp	0, 0.0	0, 0.0	0, 0.0	0.4, 0.2	0.2, 0.1	0, 0.0
PSME	2, 1.8	1, 0.6	1, 0.5	7, 1.2	13, 1.6	13, 1.4
OTHER[b]	4, 2.6	0, 0.0	0, 0.0	2, 0.5	0.4, 0.1	0, 0.0

[a] Includes both live and dead trees, ABGR = *Abies grandis*, LAOC = *Larix occidentalis*, PIPO = *Pinus ponderosa*, and PSME = *Pseudotsuga menziesii*.

[b] OTHER includes *Prunus emarginata* and *Salix scouleriana* for nest locations, and *Acer glabrum*, *Crataegus douglasii*, *Prunus* spp., *Salix scouleriana*, and Unknown spp (snags) for survey stations.

Literature Cited

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Hollenbeck, J.P., V.A. Saab, and R. Frenzel. 2011. Habitat suitability and survival of nesting white-headed woodpeckers in unburned forests of central Oregon. Journal of Wildlife Management 75(5):1061–1071.

Mellen-McLean, K., V. Saab, B. Bresson, B. Wales, A. Markus, and K. VanNorman. 2012. White-headed woodpecker monitoring strategy and protocols. USDA Forest Service, Pacific Northwest Region, Portland, OR. Unpublished document. 18 p.

Noss, R.F., P. Beier, W.W. Covington, R.E. Grumbine, D.B. Lindenmayer, J.W. Prather, F. Schmiegelow, T.D. Sisk, and D.J. Vosick. 2006. Recommendations for integrating restoration ecology and conservation biology in ponderosa pine forests of the southwestern United States. Restoration Ecology 14(1):4-10.

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Appendix 1. Transect establishment, and call-broadcast instructions and forms for monitoring of white-headed woodpecker populations and habitats on the Weiser-Little Salmon CFLRP, Payette National Forest, ID.

WHWO SURVEY TRANSECT ESTABLISHMENT FORM

FOREST: National Forest 3 or 6 digit code

Colville National Forest	COL
Okanogan-Wenatchee	OKAWEN
Wallowa-Whitman	WALWHI
Malheur	MAL
Umatilla	UMA
Ochoco	OCH
Deschutes	DES
Fremont-Winema	FREWIN
Payette	PAY

TRANSECT ID: Unique 6 character code indicating unit and transect number (e.g., TR601).

DATE: ddMMMyy (e.g., 15APR11).

AZIMUTH: Azimuth in degrees **– from true north with correction for declination.**

ZONE: UTM Zone of plot, either 10N or 11N.

RECORDER(S): Initials of person(s) collecting data, 2- to 3-letter code (e.g., **VS**=Vicki Saab). Place initials in alphabetical order when working with another person (e.g., **JD, VS**).

REVIEWER: Initials of person(s) reviewing data sheet for legibility and completeness.

FLAGGING: color of flagging used to mark point center.

POINT_ID: Unique numeric identifier (i.e., 1-10) assigned to each survey station.

UTM_E: East UTM coordinate for point center, using NAD 83.

UTM_N: North UTM coordinate for point center, using NAD 83.

Distance from previous point: Distance from point center of previous point to point center of current point in meters.

Pine dominated w/in 50 m (Y/N): Indicate if the point and 50 m radius area around the point is within pine *dominated* habitat (other species may be present). Yes or No. If necessary provide more detail in comments.

Burned > 4yrs (Y/N): Indicate if there is evidence that the station is within post-fire habitat of any age over 4 years.

Burned w/in 4 yrs (Y/N): If the station is within post-fire habitat, indicate if the area was burned within the last 4 years. This may need to be confirmed through GIS, or individuals with local knowledge.

COMMENTS: Record comments useful for relocating point center. Also record type of permanent marker used to mark plot center (e.g., aluminum tag, rebar, wildlife tree tag, etc.).

Appendix 1 (Cont).

WHWO CALL-BROADCAST SURVEYS FORM

FOREST: National Forest 3 or 6 digit code (see table above).

TRANSECT ID: Unique 6 character code indicating unit and transect number (e.g., TR601).

TRANS. LENGTH: Total length of transect in meters. This is usually 2700 m, but may be shorter to fit into available habitat.

DATE: ddMMMyy (e.g., 15APR11).

UTM_E: East UTM coordinate for point center, using NAD83.

UTM_N: North UTM coordinate for point center, using NAD83.

UTM_ZONE: UTM Zone of plot, either 10N or 11N.

VISIT #: 1, 2, or 3 (First, Second, or Third) visit of season.

OBSERVER(S): Initials of person(s) collecting data, 2-letter code (e.g., **VS**=Vicki Saab). Place initials in alphabetical order when working with another person (e.g., **JD, VS**).

REVIEWER: Initials of person(s) reviewing data sheet for legibility and completeness.

POINT ID: Unique numeric identifier (i.e., 1-10) assigned to each survey station.

BIRD SPECIES: Four-letter acronym (**WHWO** or **NONE**).

SEX: Record sex of bird; M= Male, F=Female, or U=unknown.

DET (Detection): Record whether a bird was first detected aurally or visually. **A** = auditory; **V** = visual.

DISTANCE: Place an X in the appropriate column to record the bird's location from the point (0-50m, 50-150m, >150m, or flyover).

BEHAVIOR: **F**=feeding; **FY**=feeding young; **D**=drumming; **C**=calling, **E**=excavating; **P**=perched; **FL**=flying; **O**=other (elaborate in Comments section).

Start Time: military time in hours and minutes (e.g., 1:10 pm is 1310).

TIME REMAINING: time remaining in 6.5 minute survey when WHWO is detected **for each DISTANCE category**; military time from countdown timer. **The survey is completed when you detect WHWO in the closest, 50m DISTANCE category, or 6.5 minutes has expired.**

Wind: **0**=no wind; **1**=leaves rustling; **2**=branches moving; **3**=tree trunks moving.

Weather: **0**=clear; **1**=30-70% cloud cover, no rain; **2**=$\geq$ 70% cloud cover, no rain; **3**=fog; **4**=drizzle; **5**=rain; **6**=snow.

Temp (^{o}F): Enter air temperature in degrees Fahrenheit.

COMMENTS: Record comments as necessary to elaborate on behavior of the bird.

Appendix 2. Nest monitoring instructions and forms (nest card) for white-headed woodpecker on the Weiser-Little Salmon CFLRP, Payette National Forest, ID.

NEST CARD HEADER INFORMATION

Forest: National Forest 3 or 6 digit code.

Colville National Forest	COL
Okanogan-Wenatchee	OKAWEN
Wallowa-Whitman	WALWHI
Malheur	MAL
Umatilla	UMA
Ochoco	OCH
Deschutes	DES
Fremont-Winema	FREWIN
Payette	PAY

NEST_ID: Nest sites should begin numbering with an N to avoid confusion with transects (survey stations). Nest sites should also be coded according to nearest survey transect and survey station. For example, if a nest is near survey station 5 on transect TR603, then the nest ID would be NR60305.

DATE: Numeric, **ddMMMyy** (e.g., 15APR11).

TRANSECT_ID: Record nearest transect - Unique 5 character transect number assigned by the Regional Office (e.g. TR603).

POINT_ID: Record nearest survey point. Unique numeric identifier (i.e., 1-10) assigned to each call-broadcast survey station.

Observer (S): Initials of person(s) collecting data, 2- to 3-letter code (e.g., **VS**=Vicki Saab). Place initials in alphabetical order when working with another person (e.g., **JD, VS**).

Reviewer: Initials of person(s) reviewing data sheet for legibility and completeness.

UTM_E: East UTM coordinate for nest/point center, using NAD 83.

UTM_N: North UTM coordinate for nest/point center, using NAD 83.

ZONE: UTM Zone of plot, either 10N or 11N.

BT_Distance: estimated distance from bearing tree to nest in meters.

BT_Azimuth: true compass direction (0-359°) from bearing tree to nest.

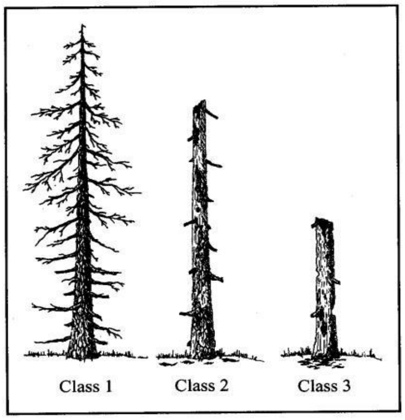
Nest Snag Location Description: Describe location and characteristics of nest snag and cavity so that the nest can be easily relocated.

Appendix 2 (Cont).

NEST CARD SNAG CHARACTERISTICS

Tree Species: four-letter tree code (e.g., PIPO = *Pinus ponderosa*). See Table 1 of Appendix 3 for common tree species.

Decay Class: Determined during vegetation surveys. Enter the numeric value for the appropriate decay class of the snag (Bull et al. 1997):



1 = Snags that have recently died, typically have little decay, and retain their bark, branches, and top.

2 = Snags that show some evidence of decay and have lost some bark and branches, and often a portion of the top.

3 = Snags that have extensive decay, are missing the bark and most of the branches, and have a broken top.

4 = Burnt snag; almost entire outer shell is case-hardened by fire; looks like charcoal (not shown above).

Snag DBH: Diameter at Breast Height (1.37 m) in centimeters, determined during vegetation survey.

Nest Ht: Nest Height in meters.

Snag Ht: Snag/tree height in meters.

Cavity Orientation: true compass bearing (0-359°) of direction cavity faces.

Top Condition: (I=Intact, BB=Broken Before Fire, BA=Broken After Fire, F=Forked, DT=Dead Top).

Aspect: True compass bearing (0-359°) of slope on which cavity tree resides, determined during vegetation survey.

Degree Slope: Degrees slope to nearest tenth, determined during vegetation survey.

Position on Slope: Position of cavity tree on slope (L=Lower, M=Middle, U=Upper).

Appendix 2 (Cont).

NEST CARD VISITATION DATA

Visit Date: Day and Month of visit (numeric).

#Eggs: Enter # eggs in nest, circle value if you are certain that the count represents the final number of eggs.

#Yng: Enter # nestlings, circle value if you are certain that the count represents the final number of nestlings.

Beg-End Time: Beginning and ending time of observations in military time (e.g., 0742-0813).

Observations: Detailed notes of observation.

Stage: Stage of nest- (E =Excavation/Nest Building, L= Laying, I=Incubation, N= Nestling, F=Fledgling).

Observer: Observer initials for each visit (e.g., VAS).

Nest Fate: Circle single best fate code -- 1-Successful, 2-10 Failed due to: 2-bear; 3-corvid; 4-squirrel; 5-chipmunk; 6-snake; 7-weather; 8-cavity destroyed (i.e., cavity tree fell or broke below cavity entrance); 9-unknown; 10-other (includes adult mortality, abandonment, ectoparasitism, predators not listed, human-caused failures). 11-Fate unknown (cannot determine from data).

Success/Failure Notes: Record detailed observations about why you think the nest was successful or failed.

Init Date: Initiation Date, Record date (ddmm) first egg was laid, if known, or calculate by backdating.

Date Fated: Date (ddmm) on which nest fledged or failed, if known, otherwise enter median date between last two visits.

 # Fledged: Number of nestlings that fledged from the nest.

Fledge Conf: Confidence that the number of fledglings reported in **# Fledged** is the final total (circle SURE or UNSURE).

Appendix 3. Instructions and forms for vegetation measurements at white-headed woodpecker nest locations and call-broadcast stations on the Weiser-Little Salmon CFLRP, Payette National Forest, ID.

PLOT ESTABLISHMENT

A vegetation plot is established at each WHWO calling station and nest site. The center of the plot is the survey point along the transect used for the playback surveys, or nest tree/snag. The plot is divided into 4 segments, each of 50-m lengths and associated variable-width rectangular plots. The plots are established by orienting line transects (segments) in 4 directions from the survey point (Figure 1). Two segments are parallel to the WHWO survey transect, and 2 segments are perpendicular to the WHWO survey transect. Segment 1 will be established using the same azimuth as the WHWO survey transect; segment 2 will be established 90 degrees in a clockwise direction; segment 3 another 90 degrees in a clockwise direction, segment 4 another 90 degrees in a clockwise direction. For nest sites, establish segments in the 4 cardinal directions, with N being segment 1.

Each 50-m segment and associated plots are numbered (1 through 4) as shown in Figure 1. Parallel segments meet at the point count center. Perpendicular segments begin 10 m from either side of survey point center and form a "plus sign" (Figure 1). Note that segment numbers for all vegetation measurements will be the same.

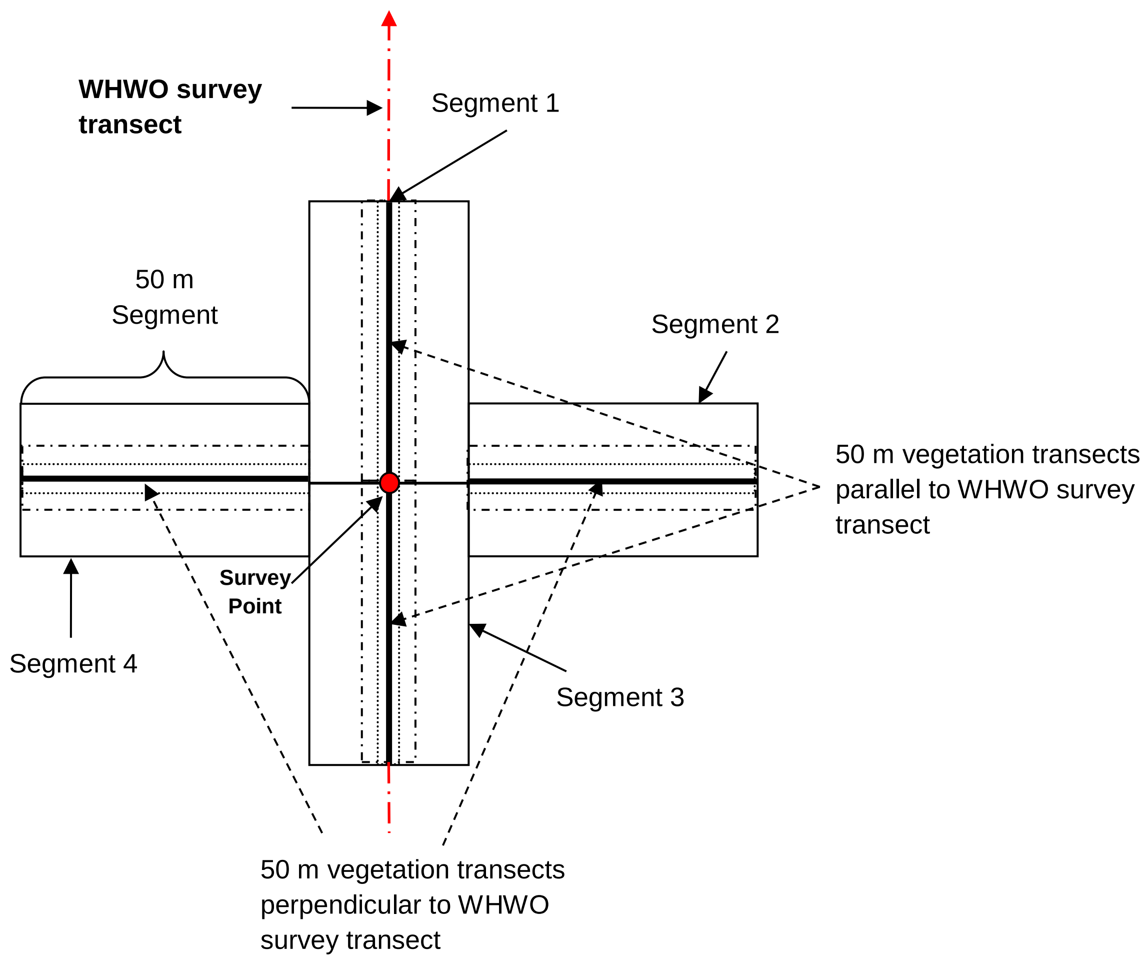


Figure 1. Sample design surrounding WHWO nests and call-broadcast stations.

Appendix 3 (Cont).

DATA FORM - LIVE TREES

TREES: If a tree has any green needles or leaves retained on it, regardless if it is upright or fallen over, treat it as a tree. If the central axis of a tree is < 3 m (< 1 m for small trees) from the center transect line, it should be measured. Use the CENTRAL AXIS at breast height (1.4 m tall) of each tree to determine whether a tree qualifies to be counted within the plot. Measure the DBH of the tree on the uphill side in steep terrain. If using a Biltmore stick and the tree has irregular growth (i.e. one side is flattened), take the mean of the DBH measured from two sides. For trees whose distances are marginal (can't visually tell how far away they are), use a tape to measure the PERPENDICULAR distance (with tape level at breast height [1.4 m] above the ground) from the transect line to the side of the tree where the central axis of the tree is located. Some trees may occur at exactly 3m from transect – to avoid issues associated with the "edge effect" of plot sampling, you should measure the first tree that occurs at exactly 3m from the center transect line and then measure every other tree that falls exactly on the edge (3m from transect).

DATE: ddMMMyy (example: 15APR11).

PLOT TYPE (circle one): Circle type of plot – survey point or nest location

TRANSECT_ID: Unique 5 character transect number assigned by the Regional Office (e.g. TR603). **For survey points only.**

POINT_ID: Unique numeric identifier assigned to each survey station (i.e., 1-10) or nest site. This will be the survey point number for vegetation plots associated with transects.

OR

NEST_ID: Assign a unique identification number to the cavity beginning first with an "N" to indicate a nest and to avoid confusion with transect ids in the database. For example, the first WHWO nest found near point count station 5 on transect TR603 would be recorded as "NTR6030501" for nest, transect "TR603", nearest point count station "05", first nest associated with this station "01". If a second nest is located and is also associated with point count station "05", it would be coded "NTR6030502".

RECORDER(S): Initials of person(s) collecting data, 3-letter code (e.g., **VAS**=Vicki A. Saab). Place initials in alphabetical order when working with another person (e.g., **JGD, VAS**). <u>Print full names in the comments section of the first datasheet.</u>

REVIEWER(S): Initials of person(s) reviewing data sheet for legibility and completeness. This should be left blank by the field crew.

COMMENTS: Record any additional comment.

Appendix 3 (Cont).

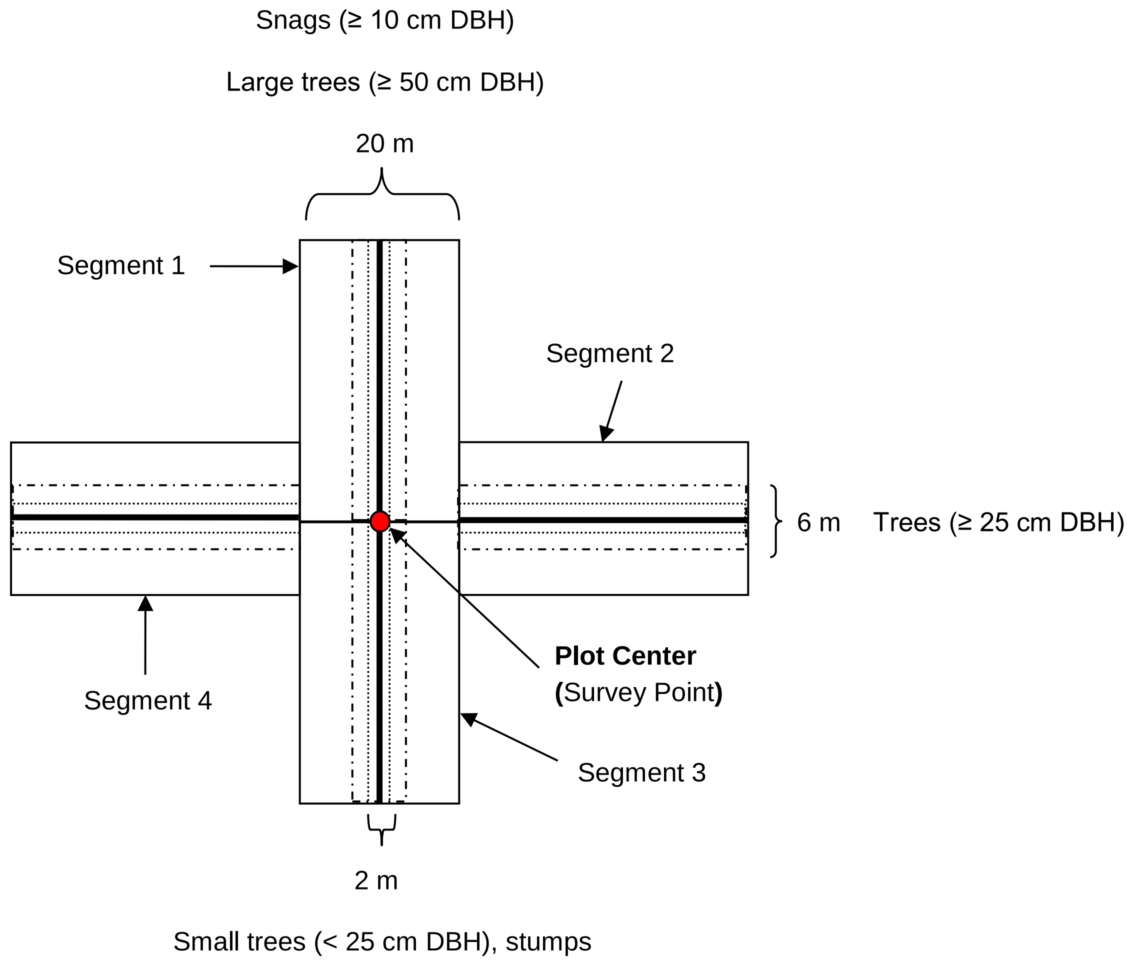


Figure 2. Variable-width rectangular plots at WHWO nests and survey points.

<u>FOR ALL DATA TABLES</u>

AZIMUTH: Compass bearing of the center transect of the rectangular plot – transect 1 will be same azimuth as WHWO survey transect or North (0) for nest sites, transect 2 will be 90 degrees in a clockwise direction, transect 3 another 90 degrees in a clockwise direction, transect 4 another 90 degrees in a clockwise direction.

SEGMENT: Unique whole number to describe 50-m rectangular plot segment within the sampling area - segments 1, 2, 3, or 4 (Figure 2). Parallel transects meet at the point count center. Perpendicular transects meet 10 m from either side of survey point center and form a "plus sign".

Live Trees ≥ 10 to < 25 cm dbh: Four 50 x 2 m segments about the plot center

TALLY: Tally all trees >10 cm and < 25 cm dbh, by species, within 1 m of center transect in each segment. Enter "9999" if there are none.

Appendix 3 (Cont).

Live Trees ≥ 25 cm dbh: Four 50 x 6 m segments about the plot center

and

Live Trees ≥ 50 cm dbh: Four 50 x 20 m segments about the plot center

For all trees ≥ 25 cm dbh and within 3 m of the center transect line, and all trees ≥ 50 cm dbh within 10 m of the center transect line, enter azimuth and segment as per above for each tree and record the following information:

Species: Enter the corresponding four- or five-letter code of the tree species. See Table 1 for tree list. If no trees are encountered in the plot segment, enter “9999”.

CLASS: Enter the numeric value for the appropriate structural class of the tree.

- **1** = Sound
- **2** = Some decay evidence (Dead top, broken top/branch, fungi, fire scars, insect evidence, woodpecker foraging)
- **3** = Broomed-trees
- **4** = Hollow

DBH: Measure the diameter at breast height (1.4 m) of the tree using calipers, a Biltmore stick, or diameter tape. Record to the nearest cm and round up if necessary. If the dbh is borderline using calipers or Biltmore stick, measure with a diameter tape.

HT (Height): Enter the height of the tree using a clinometer or laser hypsometer, to the nearest m.

CBH (Crown base height): Enter the height to the base of the tree crown. Measure LIVE crown base height (the height of the lowest live branch whorl with live branches in two quadrants exclusive of epicormic branching [brooms] and of whorls not continuous with the main crown) using a clinometer or hypsometer. Record to the nearest m.

PCD (Percent of crown dead): Enter the visual estimation of the percent of tree crown that is dead to nearest 5 percent.

CENTER TREE?: Enter the appropriate letter to indicate whether the tree under examination is the central tree of the survey station or the nest tree. <u>**Center trees should be included only in segment 1.**</u>

- **Y** = Yes
- **N =** No

Appendix 3 (Cont).

DATA FORM – SNAGS/STUMPS

HEADER INFORMATION: Enter as per instructions for Trees data sheet. UTM data for plot location do not need to be re-entered.

COMMENTS: Record and additional comments.

AZIMUTH (AZ): Compass bearing of the transect being surveyed – transect 1 will be same azimuth as WHWO survey transect or North (0) for nest sites, transect 2 will be 90 degrees in a clockwise direction, transect 3 another 90 degrees in a clockwise direction, transect 4 another 90 degrees in a clockwise direction.

SEGMENT: Unique whole number to describe 50-m rectangular plot segment within the sampling area - segments 1, 2, 3, or 4 (Figure 2). Parallel transects meet at the point count center. Perpendicular transects meet 10 m from either side of survey point center and form a "plus sign".

For all stumps < 1.4 m and ≥ 25 cm top diameter: within 1 m of the center transect line, record the following:

Natural_stumps: Tally the number of natural stumps (n) within 1 m of the center line. For the purposes of this study a natural stump is defined as any stump < 1.4 m in height and ≥ 25 cm at the **TOP of its bole** created by breakage due to natural conditions (e.g. wind, rot). Stumps are considered "in" if the center axis is within 1 m of the segment line. Enter "9999" if there are none.

Human-cut_stumps: Tally the number of cut stumps (n) within 1 m of the center line. For the purposes of this study a cut stump is defined as any stump < 1.4 m in height and ≥ 25 cm at the **TOP of its bole** that was created by a chainsaw or other mechanical means. Stumps are considered "in" if the center axis is within 1 m of the segment line. Enter "9999" if there are none.

DATA FORM – SNAGS >10 cm dbh

Snags ≥ 10 cm dbh: Four 50 x 20 m segments about the plot center.

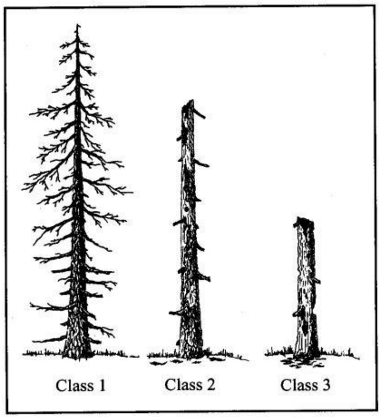
SNAGS: For the purposes of this study a snag is defined as a standing dead tree. If any green needles or leaves persist anywhere along the bole, treat it as a live tree instead of as a snag. Snags are ≥ 10 cm DBH and ≥ 1.4 m in height. For leaning dead trees, if the smallest angle between the dead tree and the ground is > 45 degrees it is a snag; otherwise it is a log. Measure the DBH of the snag on the uphill side of the snag in steep terrain. If using a Biltmore stick and the snag has irregular growth (i.e. one side is flattened), take the mean of the DBH measured from two sides. If the CENTRAL AXIS at breast height of a snag is < 10 m from the center transect line, it should be measured. For snags whose distances are marginal (can't visually tell how far away they are), use a tape to measure the PERPENDICULAR distance from the transect line to the side of the snag where the central axis is located. Some snags may occur at exactly 10 m from transect – to avoid issues associated with the "edge effect" of plot sampling, you should measure the first snag that occurs at exactly 10 m from the center transect line and then measure every other snag that falls exactly on the edge (10 m from transect).

For all snags ≥ 10 and < 25 cm dbh and within 10 m of the center transect line, record the following:

Species: Enter the corresponding four- or five-letter code of the snag species. **Do not guess at species, see Table 1**; use unknown species codes (e.g., UNKN1, UNKN2 for first and second unknown species) when species is in question. See tree species table below. If no snags are encountered in the plot segment enter "9999".

Appendix 3 (Cont).

DECAY CLASS: Enter the numeric value for the appropriate decay class of the snag (Bull et al. 1997):



1 = Snags that have recently died, typically have little decay, and retain their bark, branches, and top.
2 = Snags that show some evidence of decay and have lost some bark and branches, and often a portion of the top.
3 = Snags that have extensive decay, are missing the bark and most of the branches, and have a broken top.
4 = Burnt snag; almost entire outer shell is case-hardened by fire; looks like charcoal (not shown above).

DBH: Measure the diameter at breast height (1.4 m) of the snag using calipers, a Biltmore stick, or diameter tape to the nearest cm. Record to the nearest cm and round up if necessary. If the dbh is borderline using calipers or Biltmore stick, measure with a diameter tape.

HT (Height): Enter the height of the snag using a clinometer or laser hypsometer, to the nearest m.

FIRE SCAR? (Y/N): Does the snag have a fire scar (catface)? Do not include lightning scars that spiral down the tree or other lightning scars that do not occur near the ground.

CENTER SNAG?: Enter the appropriate letter to indicate whether the snag under examination is the central snag of a survey station or the nest snag. **<u>Center snag is included only in plot segment 1 if a snag is used as plot center.</u>**

Y = Yes
N = No

Appendix 3 (Cont).

DATA FORM – LARGE DOWN WOOD

DOWN WOOD: For the purposes of this study, DOWN LOGS are any down wood pieces or logs whose central axes (the center of the bole or the pith) are INTERSECTED by the transect line (Figure 4). Logs ≥10 cm large end diameter (LED) and 1 m in length are measured along each 50-m segment in the four directions (parallel and perpendicular to WHWO survey transect). For logs broken into two pieces, treat as one log if the pieces are touching. To qualify as a DOWN LOG the axis of the log or stem must lie above the ground (above duff and mineral soil layer). Dead stems attached to a live tree are not counted. Multiple branches attached to dead trees or shrubs are each tallied separately. For leaning dead trees, if the angle between the dead tree and the ground is < 45 degrees it is a down log; if greater, it is a snag. If the central axis of a suspended log is < 1.8 m above the ground where the transect passes, tally the log on the transect; otherwise, disregard it.

HEADER INFORMATION: Enter as per instructions for Trees data sheet. UTM data for plot location do not need to be re-entered.

AZIMUTH: Compass bearing of the transect being surveyed – transect 1 will be same azimuth as WHWO survey transect or North (0) for nest sites, transect 2 will be 90 degrees in a clockwise direction, transect 3 another 90 degrees in a clockwise direction, transect 4 another 90 degrees in a clockwise direction.

SEGMENT: Unique whole number used to describe 50-m transect within the sampling area - segments 1, 2, 3, or 4 (Figure 3). Parallel transects meet at the point count center. Perpendicular transects meet 10 m from either side of survey point center and form a "plus sign".

Down Wood ≥ 10 cm LED and ≥ 1 m long: Four 50 m transects about the plot center
For all down logs that intersect the center transect line and are ≥ 10 cm LED and ≥ 1m long, record the following:

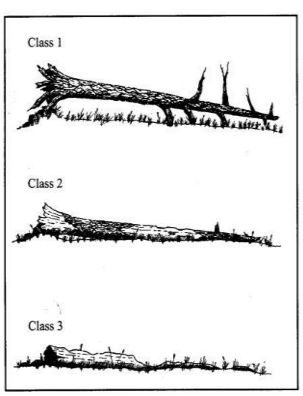
SPECIES: Enter the corresponding four- or five-letter code of the log species. If no logs are encountered along the segment (50 m), enter the code "9999".

INTERSECT: For all logs whose LED is ≥ 10 cm, record the intersect diameter to the nearest cm.

LED: Measure the large-end diameter to the nearest cm of the log. See Figure 4 to determine where the LED is on logs with different characteristics.

LENGTH: Only for those logs with LED ≥ 10 cm and ≥ 1 m long, enter the total length of the log

DECAY CLASS: Enter the numeric value for the appropriate decay class of the log (Bull et al. 1997):



1 = Logs that have recently died, typically have little decay, and retain their bark, branches, and top.

2 = Logs that show some evidence of decay and have lost some bark and branches, and often a portion of the top.

3 = Logs that have extensive decay, are missing the bark and most of the branches, and have a broken top.

4 = Burnt log; almost entire outer shell is case-hardened by fire; looks like charcoal (not shown above).

Appendix 3 (Cont).

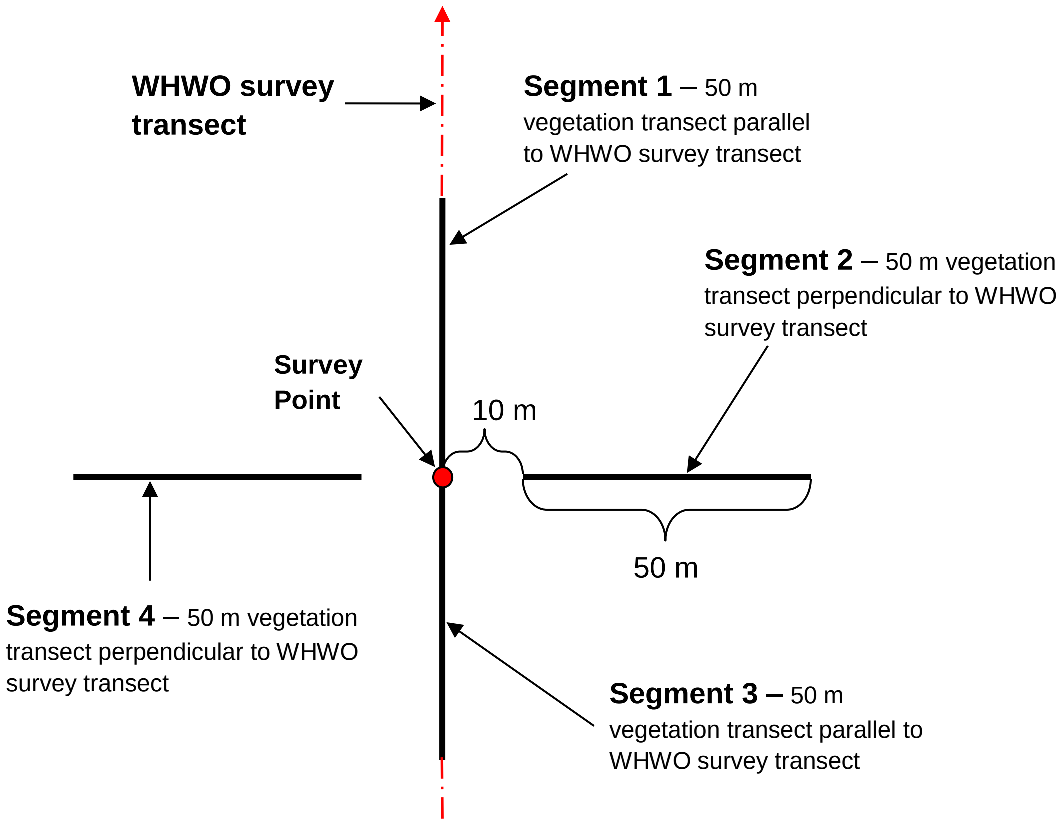


Figure 3. Line transects surrounding WHWO nests and survey points. Used for large down wood.

Appendix 3 (Cont).

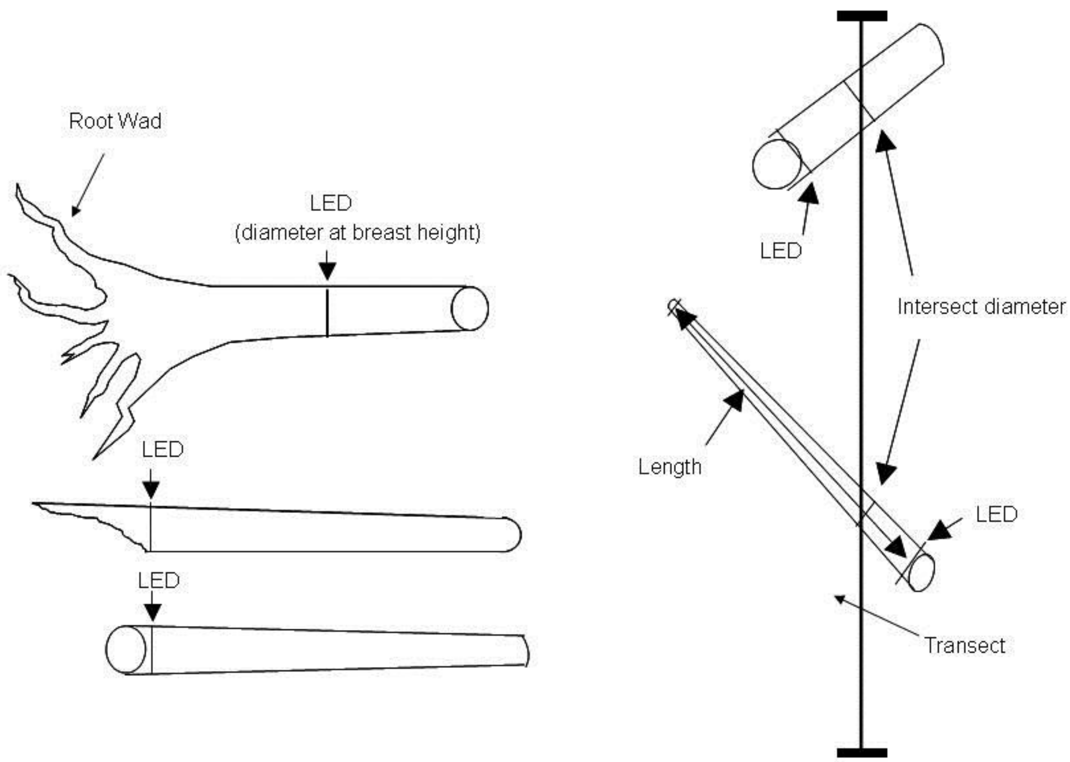


Figure 4. Sampling illustrations for large down wood.

Appendix 3 (Cont).

DATA FORM – PHOTOLOAD PLOTS - 1 to 100-Hour Fuels, Herbs, Shrubs, Litter/Duff

HEADER INFORMATION: Enter as per instructions for Trees data sheet. UTM data for plot location do not need to be re-entered.

ESTABLISH "PINWHEEL" PHOTOLOAD PLOT LOCATIONS: At each distant end of the 50-m segments 1 and 3 (along the survey transect), establish the photoload plots (see Figure 5). At each of the 2 locations, 4 photoload plots should be arranged in a clockwise pinwheel configuration with far plot corners 5 m from plot center (see Figures 6 - 7). Make sure the first photoload plot is established to the right (clockwise) direction of the 5 m line (see Figures 6 and 7). The plot is 1 x 1 m square, and a sampling frame made of PVC pipe must be assembled before the data are collected. The sampling frame is moved to each pinwheel plot location as sampling progresses. Plots are identified and numbered by both their location and position on the pinwheel. Plots at the forward-most location along the survey transect at the end of segment 1 are identified as F (Forward; Segment 1), and plots at the rearmost location along the survey transect at the end of segment 3 are identified as R (Rear; Segment 3). Within each location, plots are numbered from 1 to 4, beginning with the plot most forward along the survey transect. For example, the 1st "pinwheel" plot sampled at the rear-most location (segment 3) would be identified as: **R-1**.

Indicate Segment on data sheet header:

Segment (circle one): SEGEMENT 1 (Forward) / SEGMENT 2 (Rear)

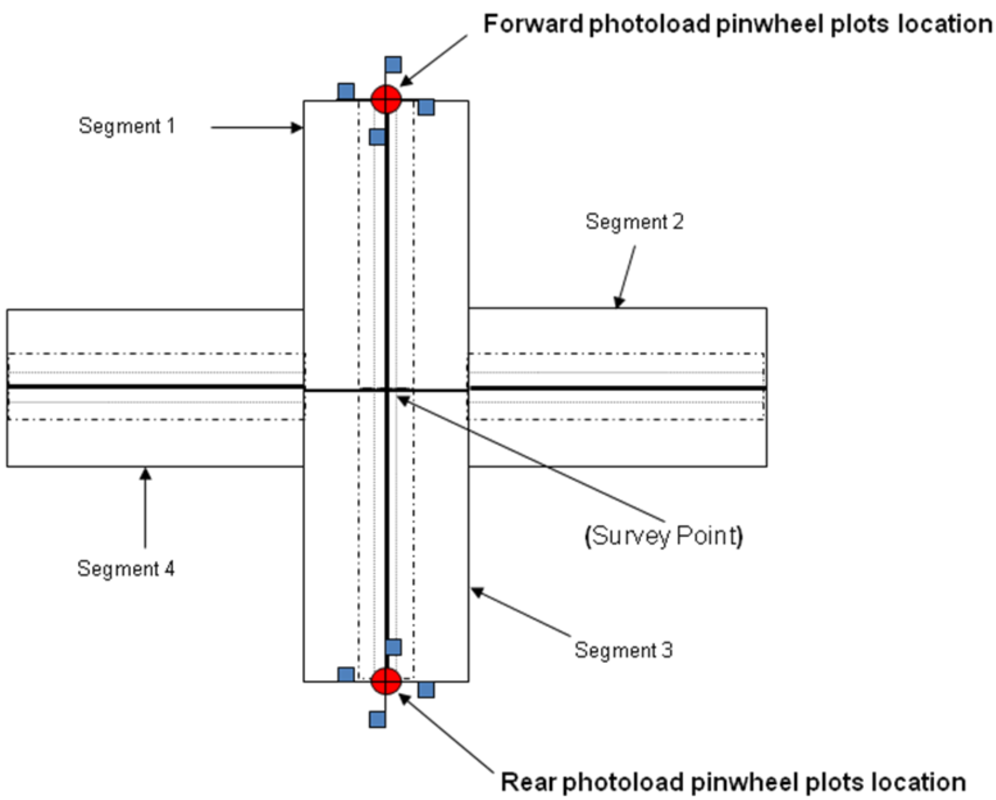


Figure 5. Location of pinwheel photoload plots at forward and rear ends of segments 1 and 3 along transect.

Appendix 3 (Cont).

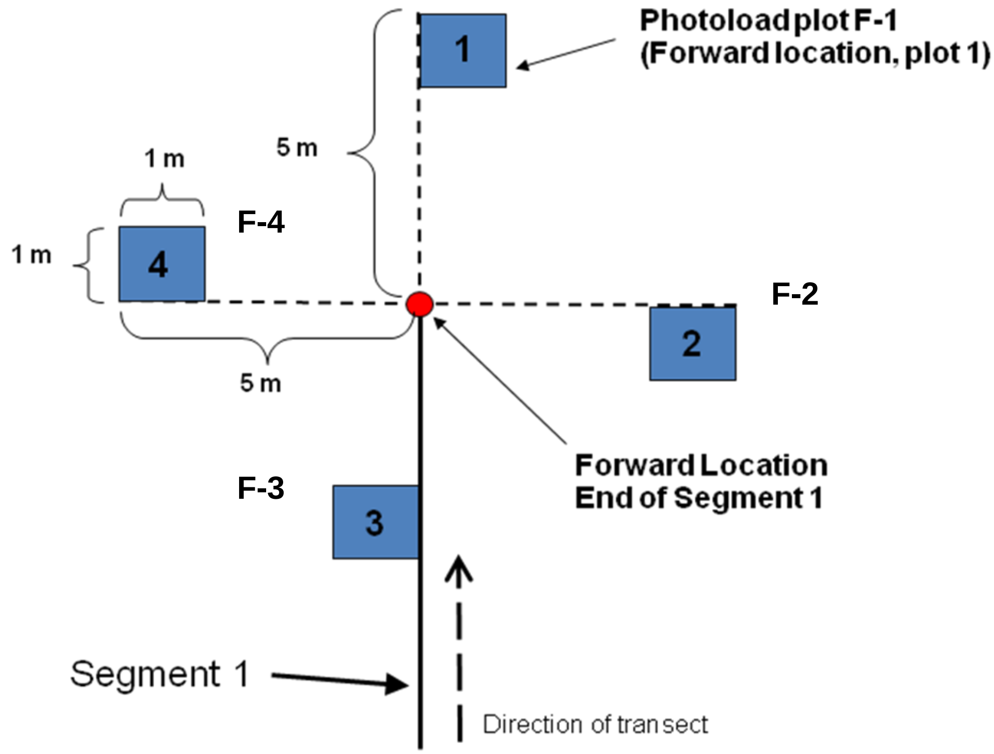


Figure 6. Arrangement of pinwheel photoload plots at end of segment 1 (Forward location).

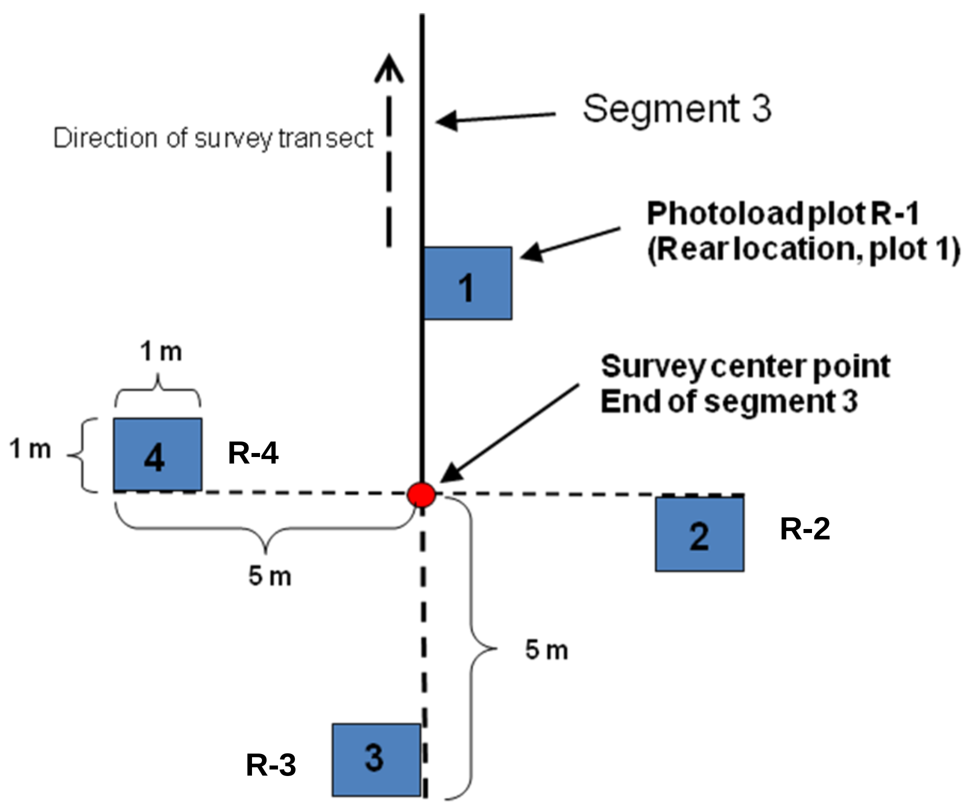


Figure 7. Arrangement of pinwheel photoload plots at end of segment 3 (Rear location).

Appendix 3 (Cont).

PHOTOLOAD SAMPLING OVERVIEW

Once the PVC sampling frame is situated, use the Photoload Sequence photos (laminated sheets) to estimate fuel loadings in the $1m^2$ photoload plot. Record your measurements for each plot in the column that corresponds to the plot number for the sampled plot. Estimating fuel loading with the photoload technique involves matching the conditions observed on the ground within the sampling plot with the conditions in the set of photographs of loadings provided in the photoload sequences. The conditions are matched only on visual assessment of loading characteristics; no other factors such as fuelbed appearance, color, or wetness should be considered. If loading seems to fall between two of the photos on the sequence sheets, choose the appropriate loading between the two loading values and record it on your data sheet.

HEADER INFORMATION: Enter as per instructions for Trees data sheet. UTM data for plot location do not need to be re-entered.

Record fuel loadings as per instructions below:

1-100 HOUR FUELS

Use your go-no-go gauge to differentiate among fuels in each of the classes: 1-hour (< 0.25 inch diameter), 10-hour (≥ 0.25 to 1 inch diameter), and 100-hour fuels (≥ 1 to < 3 inches diameter). Iteratively compute photoloads for each fuels class using the photoload sequences. The photoload sampling technique was designed to estimate loadings for the fuel components that are <u>above the litter layer and plainly visible and identifiable</u>. Some parts of twigs and branches may be buried in the litter and duff. Do not include the buried material in the loading estimate. It is not necessary to measure the height of 1-100-hour fuels. The most important guidance for estimating loadings of fine woody components is to first correctly identify the right fuel components. Three questions must be answered for the observed fuels to be sampled — **are the fuels: 1) down 2) dead, and 3) woody?**

> **1) DOWN -** the fine fuel particles must be unattached from their parent stems and be below the 2 m surface fuel height to be considered down; down fuels are those fuel components that are not attached to live or upright dead plants and are entirely on the ground or below 2 m in height. All woody fuel originating from a tree bole is considered down woody if it leans at an angle < 45 degrees from the horizontal ground. If it is at an angle > 45 degrees above horizontal, it can only be considered down if it is a broken bole or branch from a tree where at least one end of the bole is touching the ground (not supported by its own vegetation or other branches).
>
> **2) DEAD -** fuels that have no live foliage or branchwood material. Fresh slash and newly broken branches with green foliage are still considered dead even though they are technically alive, because we assume they will eventually be dead. Dormant does not mean dead. Dormant plants with no live foliage do not count as dead fuel. Examples include shrubs that have lost their leaves in the autumn and winter.
>
> **3) WOODY -** Many people are confused by woody fuel identification and tend to put stalks of annual plants, for example, into the woody category when in fact the stalks are dead herbaceous. Remember needles, detached grass blades, pine cones, and pieces of bark on the ground are considered litter and are not included in the photoload estimates.

<u>1-hour fuels</u> are smaller than or equal in diameter to 0.25 inches. Use go/no-go gauge to determine which fuels within the plot are 1-hour fuels. View plot from above and focus only on 1-hour fuels. Compare with the appropriate photoload sequence and find closest match. Record the fuel loading value (above photo; kg/m^2) on the data form. If the fuel loading within the plot appears to be between photos, interpolate the fuel loading values associated with the photo above and below what you see in the plot. If there are no 1-hour fuels within the plot, record "9999".

<u>10-hour fuels</u> are larger in diameter than 0.25 inches but equal to or smaller than 1 inch. As above, use the go/no-go gauge to determine which fuels in the plot are 10-hour fuels. Use the appropriate photoload sequence (for 10-hour

Appendix 3 (Cont).

fuels) and visually find the closest match. Record fuel loading value, or if necessary interpolated value (kg/m^2). Record "9999" if there are no 10-hour fuels in the plot.

100-hour fuels are larger in diameter than 1 inch but equal to or smaller than 3 inches. Use same methodology as with 1-hour and 10-hour fuels. Record fuel loading (kg/m^2) on data form. Enter "9999" if there are no 100-hour fuels in the plot.

Record the appropriate kg/m^2 value in the appropriate box on the data sheet for each plot (1-4).

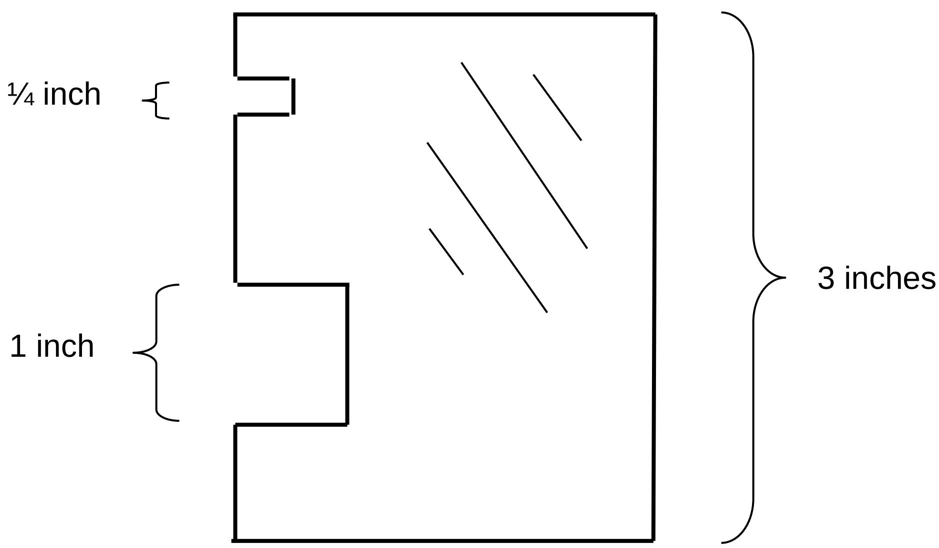


Figure 8. Example of a "go / no-go" gauge used to help identify 1-, 10-, or 100-hour fuels.

Obscured fuels: If fuels are obscured by shrubs or other vegetation as you're looking down on the plot, you should try to move the obscuring vegetation slightly to visualize the loading. The goal of the photoload sampling is to measure fuels that would interact with surface fire (as even obscured fuels would). This may be difficult in really shrubby plots and one should attempt to do their best to objectively visualize the fuels in the plot without undue effort or disturbance to other fuel/vegetation characteristics within the plot. Keep in mind that if the central axis of a piece of fuel is truly buried below ground surface, it is not included in the estimate. Also try not to disturb litter, thatch, or duff as those fuel components are measured later.

SHRUBS AND HERBS

Shrubs are woody plants that branch below or near ground level into several main stems, and have no clear trunk. They may be deciduous or evergreen, and at the end of each growing season there is no die-back of the axes. Herbs (grasses and forbs) are small, non-woody, seed-bearing plants in which aerial parts die back at the end of each growing season.

SHRUB/HERB FUEL LOAD ESTIMATION (Kg/m^2)

The first step in estimating shrub and herb loadings with the photoload technique is to identify the plant species within the sample unit. The user must estimate loading by matching the group of species occurring in the sample area with one or more of the photoload sequences. If species in your study area are not represented in the photoload sequences,

it will be necessary to match the morphology of the species observed in the field with one of the seven shrub species, two grass species, and two forb species included in the photoload photo sequences. **See Table 2 for common shrub species to determine which photoload sequence should be used.** Select the correct loading photo within the sequence based on two additional characteristics: cover and density. If there are several species of vegetation on your plot, use the most appropriate photoload sequence for each species and combine (add) the fuel loading (kg/m^2) from each to derive the overall shrub fuel loading for the plot. Measure all live shrub and herbaceous loadings within and overhanging the plot up to a 2 m height above the plot.

For shrubs and herbs, the user should try to match the pictures with field conditions based on three characteristics: species (previously discussed), cover and density. Once a picture is chosen, then the corresponding loading must be adjusted for differences between height in the picture and height in the sample area. The average height of each plant photo series is indicated at the top of each page in the photoload sequences. Adjust shrub and herbaceous loading only when the average plant height in the photos is different from the average height of plants on your plot.

**** Note:** Match grasses based on species, cover, and density regardless of whether vegetative material in the field is live or dead (only dead material is shown in the photoload sequences).

Shrubs Kg/m^2: Record shrub fuel loading on data form. Focus on live shrubs or partly living shrubs. Do not include fully dead shrubs in the fuel loading estimate.

Herbs (grasses and forbs) Kg/m^2: Record the fuel loading of herbs (grasses and forbs combined). Include both live and dead material in the herb fuel loading estimate.

SHRUB AND HERB COVER ESTIMATION (% COVER)

Leave the photoload sampling frame in place and proceed to estimate the average height (use height from fuel loading above if appropriate) and % cover of live shrubs, by species, in the 1m^2 frame. Record height to the nearest cm and % cover to the nearest 1%. This is a visual estimate of cover. If it's not possible to determine shrub species, enter genus if known. If genus is not possible, enter "UNKN1". If another unknown genus is encountered in a later plot, enter "UNKN2", and so on, and record distinguishing characteristics in the comments or field notebook. Herb cover does not need to be estimated by species. If there are no shrubs in the plot, record "9999" in the species column of the data form. If there are no herbs in the plot, record "9999" in the %Cover column of the data form.

Note: Assume a standard shrub height of 14 inches (35.6 cm) for the photos in the sagebrush (*Artemesia* spp.) photoload sequence. Adjust your shrub fuel loading estimates for these in the same manner as the remaining photoload sequences (e.g., Snowberry [*Symphoriocarpus albus*]).

Shrub species: Use species codes from Table 2 at the end of the document. Note: Make sure to label UNKN shrub specimens with appropriate UNKN code (UNKN1, UNKN2, UNKN3, etc.).

Percent cover: percent cover estimate in 10% increments.

Avg. Height (cm): Use a ruler or a tape measure to measure and record the average height (cm) of shrubs and herbs in the photoload plots.

SEEDLING COVER ESTIMATION (% COVER)

Leaving the photoload sampling frame in place, estimate the % cover of seedlings, by species or UNKN (unknown), within the 1m^2 plot. Seedlings are trees ≤ 1.4 m tall.

Tree seedling species: Record species code from Table 1 at the end of the document. Note: Make sure to label UNKN tree specimens with appropriate UNKN code (UNKN1, UNKN2, UNKN3, etc.).

Appendix 3 (Cont).

% Cover: Record % cover of each species separately for plots 1-4.

FUEL DEPTH

Litter/Duff fuel depth is measured at points 4 and 5 m from plot center (survey point) within each photoload plot, along the trailing edge of the plot frame as you sweep clockwise around the pinwheel (see Figure 9). There are a total of 8 sample locations in each pinwheel plot group.

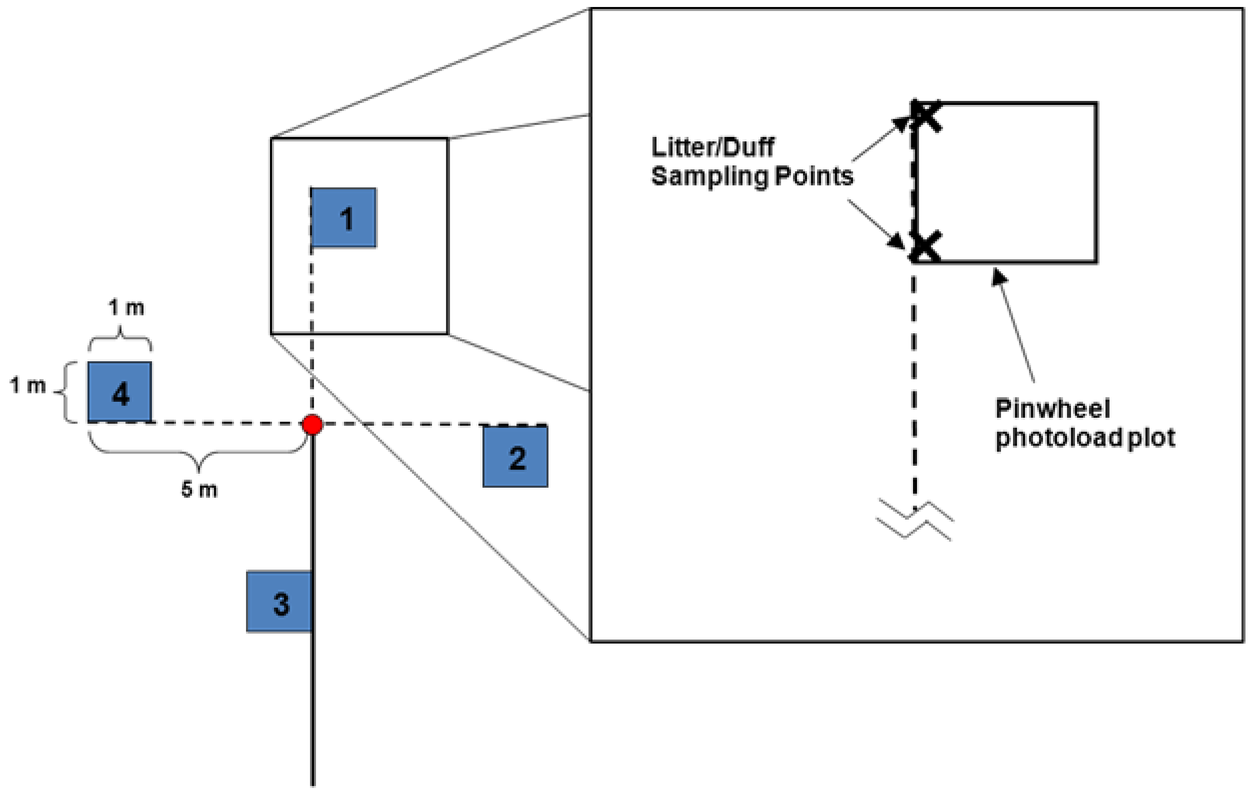
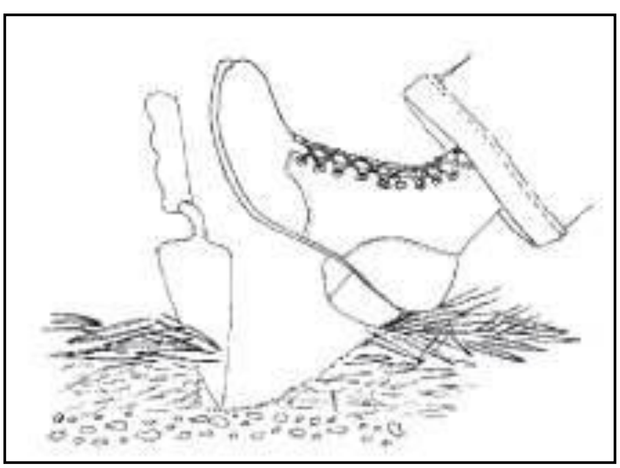


Figure 9. Location of 2 of the 8 litter/duff sampling points (at corners of photoload plot, 4 and 5 m from center point.

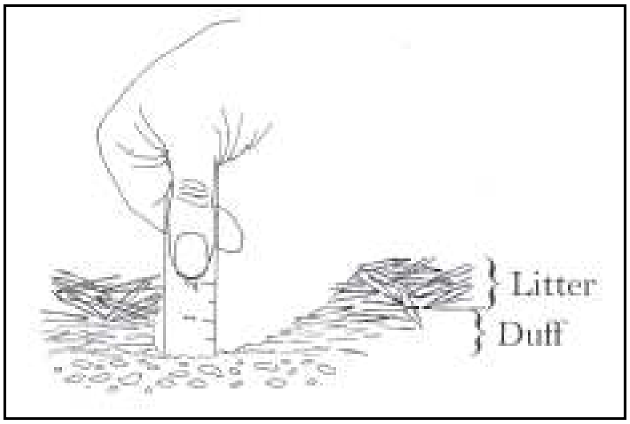


Appendix 3 (Cont).

1) Use your boot or a small shovel to carefully pull the litter and duff layers away until you are down to mineral soil.

Litter is the surface layer of the forest floor that is not in an advanced stage of decomposition, usually consisting of freshly fallen leaves, needles, twigs, stems, bark, cones, and fruits.

Duff is the partially decomposed organic material of the forest floor beneath the litter.



2) Use a plastic ruler to estimate combined duff and litter depth from the surface of the mineral soil to the top of the litter layer, including any decomposing material that might be present.

Record depth (cm) in the appropriate box for plots 1-4. For trace amounts of duff or litter record "0.001".

3) Examine the duff/litter profile and estimate the percent of the total depth that is made up of litter, to the nearest 10%.

Record % liter in the appropriate box for plots 1-4.

Appendix 3 (Cont).

DATA FORM – SAPLING TALLY
SAPLING TALLY BY SPECIES AND DIAMETER CLASS (4-m-radius circular plot at pinwheel center; Figure 10)

Within a 4-m-radius circular plot, located at the center of each pinwheel (see Figure 10), tally the live saplings within the plot by species and diameter class. Saplings are trees with a dbh < 10cm and > 1.4m high. Saplings tallied in these plots may have disease or damage, they should still be tallied as long as they are standing, have green leaves, and meet the diameter/height criteria.

Species: See list of tree species (Table 1) used in live-tree sampling. Tally all the saplings of a species within each of the 2 diameter classes (below). **Each row of the form should correspond to one species-diameter class combination.**

Diameter Class: Saplings are tallied in 2 diameter classes; 0 to <5 cm, and 5 to <10 cm. Enter **"2.5"** in the Dia. Class column when tallying saplings in the 0-5 cm diameter class and **"7.5"** when tallying saplings in the 5-10 cm class.

Average Height: Enter the average height of a diameter class – species combination to the nearest 0.1 m.

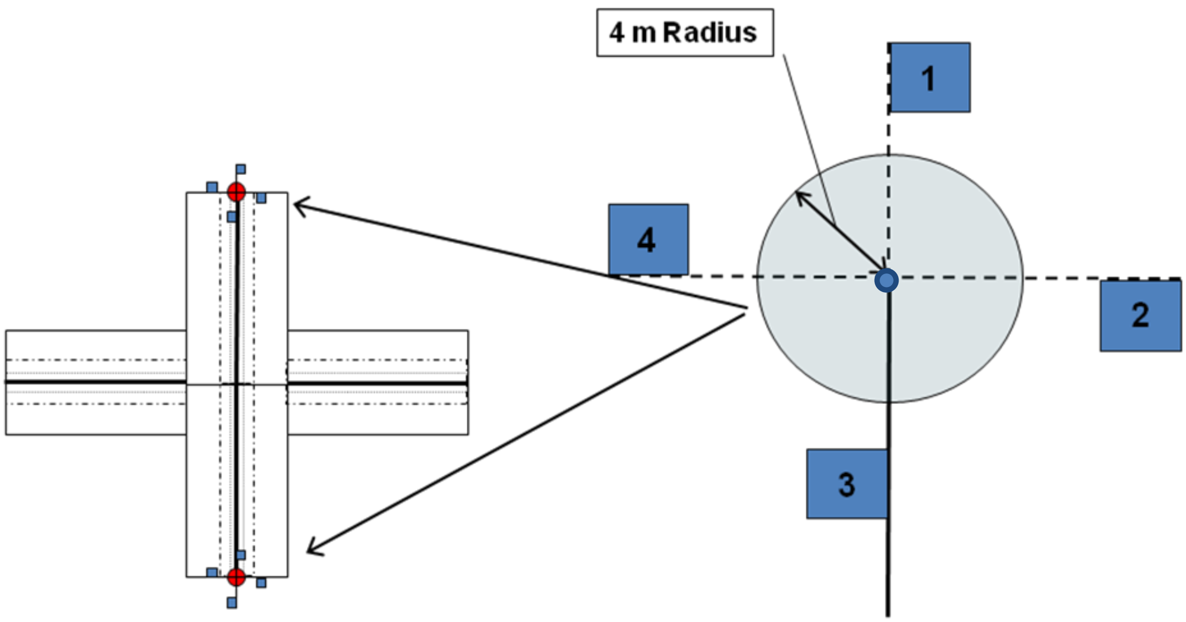


Figure 10. Sapling plot (4 m radius circular plot) at each pinwheel location.

Appendix 3 (Cont).

Table 1. Tree species codes.

Code			Code		
	Pines			**Douglas-fir - Redwood**	
PIAL	Whitebark pine	*Pinus albicaulis*	PSME	Douglas-fir	*Pseudotsuga mensziesii*
PIAT	Knobcone pine	*Pinus attenuata*	SEGI	Giant Sequoia	*Sequioa*
PICO	Lodgepole pine	*Pinus contorta*	SESE2	Coast redwood	*Seguoiadendron sempervirens*
PIFL	Limber pine	*Pinus flexilis*			
PIJE	Jeffrey pine	*Pinus jeffreyi*		**Cedar - Larch**	
PILA	Sugar pine	*Pinus lambertiana*	CADE3	Incense-cedar	*Calocedrus decorum*
PIMO	Western white pine	*Pinus monticola*	CHLA	Port-Orford-cedar	*Chamaecyparis lawsoniana*
PIPO	Ponderosa pine	*Pinus ponderosa*	CHNO	Alaska-cedar	*Chamaecyparis nootkatensis*
			LALY	Subalpine larch	*Larix lyallii*
	True firs		LAOC	Western larch	*Larix occidentalis*
ABAM	Pacific silver fir	*Abies amablis*	THPL	Western redcedar	*Thuja plicata*
ABCO	White fir	*Abies concolor*			
ABGR	Grand fir	*Abies grandifola*		**Spruce - Hemlock**	
ABLA2	Subalpine fir	*Abies lasiocarpa*	PIBR	Brewer Spruce	*Picea brewerii*
ABMA	California red fir	*Abies magnifica*	PIEN	Engelmann spruce	*Picea engelmanni*
ABMAS	Shasta red fir	*Abies shastensis*	PISI	Sitka spruce	*Picea sitkensis*
ABPR	Noble fir	*Abies princeps*	TSHE	Western hemlock	*Tsuga heterophylla*
			TSME	Mountain hemlock	*Tsuga mertensiana*
				Unknown Species*	
JUOC	Western juniper	*Juniperus occidentalis*	TREEC	Unknown conifer	
TABR	Pacific yew	*Taxus brevifola*	TREED	Unknown Hardwood	
			UNKN1	Unknown Species 1	
	Hardwoods		UNKN2	Unknown Species 2	
CELE3	Curly-leaf mountain mahogany	*Cercocarpus ledifolius*		* (*Do not use for objects*)	
POTR	Quaking aspen	*Populus tremuloides*			
POTRI	Black cottonwood	*Populus trichocarpa*			

Appendix 3 (Cont).

Table 2. Shrub Species Codes.

Code	Common Name	Scientific Name	Photoload Reference spp.
ACCI	Vine maple	*Acer circinatum*	*Amelanchier alnifolia*
ACGL	Rocky Mountain maple	*Acer glabrum*	*Amelanchier alnifolia*
AMAL	serviceberry	*Amelanchier alnifolia*	*Amelanchier alnifolia*
ARTRV	Big sagebrush	*Artemisia tridentata*	*Artemesia spp*.(Sagebrush photoload)
ARUV	bearberry; kinnikinnick	*Arctostaphylos uva-ursi*	*Vaccinium scoparium*
ARNE	Pinemat manzanita	*Arctostaphylos nevadensis*	*Amelanchier alnifolia*
ARPA	Green leaf manzanita	*Arctostaphylos patula*	*Amelanchier alnifolia*
BEAQ	Oregon grape	*Berberis aquifolium*	*Berberis repens*
BENE	Cascade Oregon grape	*Bereberis nervosa*	*Berberis repens*
BERE	Creeping Oregon grape	*Bereberis repens*	*Berberis repens*
CACH	Golden chinquapin	*Castanopsis chrysophylla*	*Amelanchier alnifolia*
CEVE	snowbrush ceanothus	*Ceanothus velutinus*	*Amelanchier alnifolia*
CHISP	Prince's pine	*Chimaphila sp.*	*Vaccinium scoparium*
CHRSP	rabbitbrush	*Chrysothamnus sp.*	*Artemesia spp*.(Sagebrush photoload)
HODI	ocean-spray	*Holodiscus discolor*	*Amelanchier alnifolia*
LOSP	honeysuckle	*Lonicera sp.*	*Symphoricarpos albus*
PHLE	mockorange, syringa	*Philadelphus lewisii*	*Amelanchier alnifolia*
PHMA	ninebark	*Physocarpus malvaceus*	*Symphoricarpos albus*
PREM	bittercherry	*Prunes emarginata*	*Symphoricarpos albus*
PUTR	bitterbrush	*Purshia tridentata*	*Artemesia spp*.(Sagebrush photoload)
RISP	currant	*Ribes sp.*	*Symphoricarpos albus*
RIAU	golden currant	*Ribes aureum*	*Symphoricarpos albus*
RICE	wax current	*Ribes cereum*	*Symphoricarpos albus*
RHAL	Cascade azalea	*Rhododendron albiflorum*	*Amelanchier alnifolia*
ROSP	Rose	*Rosa sp.*	*Symphoricarpos albus*
RUSP	Bramble, blackberry	*Rubus sp.*	*Amelanchier alnifolia*
SASP	willow	*Salix sp*	*Amelanchier alnifolia*
SACE	Blue elderberry	*Sambucus cerulea*	*Amelanchier alnifolia*
SARA	red elderberry	*Sambucus racemosa*	*Amelanchier alnifolia*
SPBE	Birchleaf spiraea	*Spiraea betulifolia*	*Amelanchier alnifolia*
SPSP	Spirea	*Spirea sp.*	*Symphoricarpos albus*
SYSP	snowberry	*Symphoricarpos sp.*	*Symphoricarpos albus*
SYAL	Common snowberry	*Symphoricarpos albus*	*Symphoricarpos albus*
SYOR	Mountain snowberry	*Symphoricarpos oreophilus*	*Symphoricarpos albus*
VASP	huckleberry	*Vaccinium sp.*	*Vaccinium globulare or scoparium*
VASC	grouse Huckleberry	*Vaccinium scoparium*	*Vaccinium scoparium*
XETE	beargrass	*Xerophyllum tenax*	*Xerophyllus tenax*
UNKN1	Unknown species 1	*Collect specimen for later identification*	
UNKN2	Unknown species 2	*Collect specimen for later identification*	